Journal of Crop and Weed, 15(1): 209-212 (2019)

Influence of different doses of pyrazosulfuron-ethyl and establishment methods on the yield of lowland rice (*Oryza sativa* L.)

T. MALEMNGANBI AND J. LHUNGDIM

Department of Agronomy, College of Agriculture
Central Agricultural University, Imphal-795004, Manipur

Received : 28-06-2018 ; Revised : 11-12-2018 ; Accepted : 27-03-2019

ABSTRACT

Field experiment to determine "influence of different doses of pyrazosulfuron-ethyl and establishment methods on the yield of lowland rice" was conducted at the Research Farm of College of Agriculture, Central Agricultural University, Imphal, Manipurduring the Kharif season of 2017. The experiment comprised of four doses of pyrazosulfuron-ethyl i.e. 0, 15, 25 and 35 g a.i.ha^{-1} and threecrop establishmentmethods i.e. broadcasting, drum seeding and transplanting method.The result revealed that among the different doses, pyrazosulfuron-ethyl @ 35g a.i.ha^{-1}was most effectivein suppressing weeds, decreasing dry matter and highestweed control efficiency. Among the different establishment methods, transplanting was found to be the most effective method. It was also evident that the combined effect ofpyrazosulfuron-ethyl @ 35g a.i.ha^{-1}along with transplanting method recorded significantly higher yield attributes and grain yield. However,pyrazosulfuron-ethyl @ 35g a.i.ha^{-1}under drum seeding resulted in highest B:C ratio.

***Keywords*:** Crop establishment methods, pyrazosulfuron-ethyl, weed, weed control efficiency and yield

Rice is the staple food of Manipur and is grown both in the hill and plain areas during *Kharif* season after harvest of *Rabi* crops or pre *Kharif* / *Rabi* crops. Cultivation is entirely mono-crop with rice accounting for about 98 per cent of food grains production and about 72 per cent of cropped areas are under paddy cultivation.Among all the factors affecting the growth, yield attributes and yield besides cost of cultivation and labour requirement in rice cultivation, planting methods and presence of weeds have significant impacts. Transplanting is the most dominant and traditional method in Manipur.However,direct seeded rice is popular among the farmers of Manipur due to scarcity and high labour cost besides time consuming nature of transplanting method. Drum seeding is another alternative method of transplanting, as it reduces labour requirement and performs as good as transplanting method at many places (Yadav and Singh, 2006).Irrespective of the methods of rice establishment, weeds are a major biotic cause of yield reduction in any system of rice cultivation ranging from 15 to 90 per cent.Globally, actual rice yield losses due to pests have been estimated at 40 per cent out of which weeds account for 32 per cent. In India, unchecked weed competition causes yield losses to the tune of 50-65per cent in rice (Subbaiah and Sreedevi, 2000).Out of the losses due to various biotic stresses, weeds are known to account for nearly one third of the total loss.Thus, effective controlling of weed is a major pre-requisite for better growth and productivity of rice in all the establishment methods. Hand weeding is the traditional weed control measures and still being the most popular in rice cultivation. But due to high labour cost, non-availability of labour and huge time requirement, this operation is uneconomical and unaffordable to the poor farmers. So, farmers are forced to opt for other alternative measures like chemical weed control or mechanical weed control measures. Removal of the weeds at the critical period by mechanical means is also not possible due to the unfavourable weather conditions. So in such situations, different herbicides are used for better control of weeds. Pyrazosulfuron-ethyl (Saathi) is one the promising and commonly used weedicides in Manipur and is found to be an effective for complex weed flora in rice. It is applied as a pre-emergence herbicide in both irrigated and rainfed rice. It has both soil and foliar activity (Rajkhowa *et al*., 2006). It controls grasses and most effective against sedges and broad-leaved weeds. Different doses of this herbicide need to be tested in Manipur conditions to find out the most efficient, cost effective, less toxic dose under different crop establishment methods.

A field experiment was conducted to study the influence of different doses of pyrazosulfuron-ethyl and different establishment methods on the yield of lowland rice (*Oryza sativa* L.), at Research Farm of College of Agriculture, Central Agricultural University, Imphal, Manipur during the *Kharif* season of 2017. The experimental site is located at 24^0 80′ N latitude and 93^0 89′ E longitudes and at altitude of 766 m above mean sea level, characterized by dry winters and a hot monsoon seasonand winter normally begin from the mid November and stay on till the end of February. The total rainfall recorded during the crop period was 1537.7 mm. The soil of the experimental field was clay and acidic in nature (pH 5.83), highly fertile with high

Short communication
Email : malemnganbimayum@gmail.com

available organic carbon (2.37%), medium in available nitrogen (287.08 kg ha^{-1}) and available phosphorus (16.73 kg ha^{-1}) and moderately high available potassium (219.87 kg ha^{-1}).The experiment was laid out in factorial randomized block design (FRBD) with 12 treatments and 3 replications. Treatment consists of 4 doses of pyrazosulfuron-ethyl 10 % WP (D_0: control, D_1: 15 g ha^{-1}, D_2: 25g ha^{-1}, and D_3: 35g ha^{-1}) and 3 establishment methods (M_1: Broadcasting direct seeded rice, M_2: Drum seeding at a spacing 20×10 cm and M_3: Manual transplanting method at a spacing of 20×10 cm). The recommended dose of fertilizers (60:40:30 kg N: P_2O_5: K_2O ha^{-1}) was applied in the rice field. The entire quantity of phosphorus and potassium and half of nitrogen was applied as basal at the time of sowing and transplanting while the remaining N was applied in two equal splits at active tillering and panicle initiation stages. For transplanting, 27 old seedlings were used. Theherbicide at different doses was applied at 5 DAS/T as per treatments with knapsack sprayer fitted with flat fan nozzle using 35 litresof water ha^{-1}uniformly across the plot. Weeds population categorized as broad-leaved weeds, sedges and grasses were sampled and oven dried.Both the data on weed count and dry weight were subjected to square root transformatio ($\sqrt{x} + 0.5$) prior to statistical analysis for test of significance. Weed control efficiency of different treatments was determined by using the formula :

$$WCE(\%) = \frac{DWC - DWT}{DWC} \times 100$$

Where, WCE = Weed control efficiency (%)

DWC= Dry matter production of weeds in the un-treated plot (control) (g m^{-2})

WCT = Dry matter production of weeds in the treated plot (g m^{-2})

The plant height was recorded at 30, 60 DAS/T and at harvest. The yield attributes and yield were recorded at maturity.

Effect on weeds

The experimental field was infested with threecategories of weeds *i.e.* broad-leaved weeds like *Ludwigiaparviflora, Monochoria vaginalis, Ecliptaalba*etc. ; grasses like *Echinochloa colona, Echinochloacrusgallis, Paspalum scorbiculatum*etc. and sedges like *Fimbristylis miliacea, Cyperus iria, Cyperus difformis, Scripus juncoides* etc. With the increase in doses of tested herbicide pyrazosulfuron-ethyl, the density of all the three categories of weed and total dry weight of weeds also gradually decreased as presented in the table-1. Lowest density and total dry matter of weeds was recorded with application of pyrazosulfuron-ethyl @ 35 g *a.i.*ha^{-1} at harvest. This confirms the findings of Deepthi and Subramanyam (2010). Sharma *et al.* (2004) also revealed that in transplanting method, weed density and weed dry weight obtained with the application of pyrazosulfuron-ethyl @ 35 and 40 g ha^{-1} were significantly lower at 3 and 6 DAT than its lower doses. Among the different doses of herbicide, highest weed control efficiency (based on dry weight) was observed in pyrazosulfuron-ethyl (87.86%) at 35 g *a.i.* ha^{-1}. Acharya and Bhattarcharya (2013) reported that Pyrazosulfuron-ethyl @30g *a.i.*ha^{-1} applied as pre-emergence recorded a weed control efficiency of 71.78 per cent that was found to be the most effective.

Among the crop establishment methods, broadcasting and drum seeding registered higher population of broad-leaved weeds, sedges and grasses as well as total dry weight at harvest (Table 1). The reason behind this may be due more favorable condition for weed seeds germination, their emergence and survival provided by sowing of pre-germinated and sprouted seeds of rice in puddled wet soil. Talla and Jena (2014) also revealed that total weed density and weed dry matter was higher in drum seeding than transplanting method at 30 DAS/T.Transplanting method had the lowest population of weeds and total dry weedswhile drum seeding DSR method had the highest total dry weeds at harvest.Crop establishment methods also influenced weed control efficiency and transplanting method revealed the highest weed control efficiency (57.91%) followed by drum seeding (56.05%) at harvest.Broadcasting DSR revealed thelowestweed control efficiency (55.30%) which remained at par with drum seeding. This confirms the findings of Hassan and Upasani (2015).

The interaction effect of different doses of pyrazosulfuron-ethyl and establishment methods was found to be significant on density of sedges and grasses but non-significant on density of broad-leaved weeds, total dry weight of weeds and weed control efficiency.

Effect on crop

Application of pyrazosulfuron-ethyl @ 35g *a.i.*ha^{-1} (D_3) recorded maximum grain yield of 36.86 q ha^{-1} and straw yield of 55.37 q ha^{-1} which was statistically superior to other doses of tested herbicide due to more number of effective tillers m^{-2}, panicle length, filled grains per panicle and test weight as presented in the table 2. However all three doses of pyrazosulfuron-ethyl showed almost similar grain and straw yield compared to control plot. Rajkhowa *et al*. (2006) also reported that Pyrazosulfuron-ethyl at 20, 25 or 30g *a.i.*ha^{-1} showed similar yield with highest 4.8t ha^{-1} at 25g ha^{-1} and recorded 45per cent increased in grain yield over weedy check.In terms of net returns and benefit cost ratio, pyrazosulfuron-ethyl @ 35g *a.i.*ha^{-1}recorded the maximum value as presented in table 2.

Table 1: Effect of different doses of pyrazosulfuron-ethyl and establishment methods on weeds at harvest

Treatments	Broad-leaved weeds (No.m^{-2})	Sedges (No.m^{-2})	Grasses (No.m^{-2})	Total dry weight (g m^{-2})	WCE %
Control (D_0)	6.08 (37.56)	3.71 (14.22)	3.27 (10.67)	20.84 (209.33)	0.00
PSE 10%WP @ 15g *a.i.*ha^{-1} (D_1)	4.76 (22.44)	2.40 (5.33)	2.85 (7.78)	13.31 (76.60)	62.80
PSE 10%WP @ 25g *a.i.* ha^{-1} (D_2)	4.35 (18.89)	1.99 (3.56)	2.26 (4.67)	10.82 (52.22)	75.03
PSE 10%WP @ 35g *a.i.* ha^{-1} (D_3)	3.52 (13.11)	1.51 (2.00)	2.00 (3.56)	7.59 (26.20)	87.86
SEm (±)	**0.29**	**0.12**	**0.09**	**0.45**	**2.28**
LSD (0.05)	**0.84**	**0.35**	**0.27**	**1.33**	**6.68**
Broadcasting (M_1)	5.06 (25.50)	2.77 (8.83)	2.44 (5.67)	14.42 (107.27)	55.30
Drum seeding (M_2)	4.52 (21.17)	2.26 (4.83)	2.96 (9.00)	15.36 (124.48)	56.05
Transplanting (M_3)	4.46 (22.33)	2.17 (5.17)	2.39 (5.33)	9.64 (41.52)	57.91
SEm (±)	**0.25**	**0.10**	**0.08**	**0.39**	**1.97**
LSD (0.05)	**NS**	**0.31**	**0.23**	**1.15**	**NS**
D × M					
SEm (±)	**0.49**	**0.21**	**0.61**	**0.78**	**3.94**
LSD (0.05)	**NS**	**0.61**	**0.46**	**NS**	**NS**

Note: Data are transformed to "X + 0.5 and original figures are givenin parenthesis

Table 2: Plant height, effective tillers, panicle length, filled grains, test weight, grain and straw yield, net returns and benefit cost ratio as influenced by the different doses of pyrazosulfuron ethyl and establishment methods

Treatments	Plant height at harvest (cm)	Effective tillers (number m^{-2})	Panicle length (cm)	Filled grains per panicle (number m^{-2})	Test weight (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Net returns (Rs.)	B : C ratio
Control (D_0)	104.87	262.44	21.84	45.29	28.89	23.17	34.68	12110.78	0.29
PSE 10%WP @ 15g *a.i.*ha^{-1} (D_1)	108.47	279.56	23.89	87.36	29.62	34.23	48.76	36419.22	0.87
PSE 10%WP @ 25g *a.i.* ha^{-1} (D_2)	109.91	287.23	23.84	90.07	29.67	35.94	50.89	39880.11	0.95
PSE 10%WP @ 35g *a.i.* ha^{-1} (D_3)	110.56	310.64	24.26	98.31	30.33	36.86	55.37	42241.89	0.99
SEm (±)	**1.54**	**11.48**	**0.27**	**3.21**	**0.37**	**0.22**	**0.47**	**435.44**	**0.01**
LSD (0.05)	**NS**	**NS**	**0.79**	**9.41**	**NS**	**0.66**	**1.38**	**1277.09**	**0.03**
Broadcastinging (M_1)	105.02	259.33	22.35	61.80	29.33	30.56	46.64	29662.33	0.72
Drum seeding (M_2)	111.42	275.58	23.97	84.55	29.55	32.70	49.79	34926.50	0.86
Transplanting (M_3)	108.92	320.00	24.02	94.42	30.00	34.38	45.85	33400.17	0.75
SEm (±)	**1.34**	**9.95**	**0.23**	**2.78**	**0.32**	**0.19**	**0.41**	**377.10**	**0.01**
LSD (0.05)	**3.92**	**29.17**	**0.68**	**8.15**	**NS**	**0.57**	**1.20**	**1105.99**	**0.03**
D × M									
SEm (±)	**1.96**	**19.89**	**0.47**	**5.56**	**0.65**	**0.39**	**0.75**	-	-
LSD (0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**1.14**	**2.19**	-	-

Among the crop establishment methods,transplanting method of rice establishment recorded higher grain yield (34.38 q ha^{-1}) followed by drum seeding (32.70 q ha^{-1}). It also recorded the maximum number of effective tillers m^{-2}, panicle length, filled grains per panicle and test weight as compared to other establishment methods and presented in table 2.This confirms the findings of Hassan and Upasani (2015) and Singh *et al*. (2017). Sandhyakanthi *et al*. (2014) also reported that transplanting method revealed maximum grain yield of rice (5406 kg ha^{-1}) which was statistically at par with drum seeding of sprouted seeds (5071 kg ha^{-1}), while it was lowest with broadcasting of sprouted seeds (4432 kg ha^{-1}). However straw yield was recorded maximum under drum seeded method of rice establishment (49.79 q ha^{-1}) followed by broadcasting DSR (46.64 q ha^{-1}) which remained statistically at par with transplanting method of rice (46.10 q ha^{-1}) respectively. This confirms the findings of Sandhyakanthi *et al*. (2014).In terms of net returns and benefit cost ratio, drum seeding recorded the maximum value as presented in the table 2. The beneficial interaction effect of different doses of pyrazosulfuron-ethyl and establishment methods was found to be non-significant on plant height, number of effective tillers, panicle length, filled grains per panicle and test weight however, it was found to be significant on grain and straw yield.

It can be concluded that application of pyrazosulfuron-ethyl @ 35g *a.i.* $ha^{-1}$was most effective in controlling weeds and among the establishment methods, transplanting method of rice was most appropriate in terms of higher yield and yield attributes. However,drum seeding recorded almost similar grain yield as transplanting and maximum net returns and benefit cost ratio as it was less labour intensive than transplanting method. Thus, application of pyrazosulfuron-ethyl @ 35g *a.i.*ha^{-1} and drum seeding can be adopted for effective weed control measures and higher grain yield of lowland rice for sustainable crop production.

REFERENCES

Acharya, S.S. and Bhattacharya, S.P. 2013. Comparative efficiency of pyrazosulfuron ethyl and bentazon with acetamides for weed control in transplanted *boro* rice (*Oryza sativa*) in the Lower Gangetic Plain Zone of West Bengal, India. *Int. J. Bio-resour. Stress Mgmt.*, **4**:506-09.

Deepthi, K. Y. and Subramanyam, D. 2010.Performance of pre emergence herbicides on weed flora and yield of transplanting method (*Oryza sativa*). *Indian J. Weed Sci*., **42**:229-31.

Hassan, D. and Upasani, R. R.2015. Effect of crop establishment and weed control methods on productivity of rice (Oryza sativa L.). *J. Crop and Weed*, **11**:228-30.

Rajkhowa, D.J., Borah, N., Barua, I.C. and Deka, N.C. 2006.Effect of Pyrazosulfuron-ethyl on Weeds and Productivity of Transplanting method during Rainy Season. *Indian J. Weed Sci*., **38**: 25-28.

Sandhyakanthi , M.S., Ramana, A.V. and Ramanamurthy, K.V. 2014. Effect of different crop establishment techniques and nutrient doses on nutrient uptake and yield of rice (*Oryza sativa* L.). *Karnataka J. Agric. Sci*., **27**: 293-95.

Sharma, S.D., Punia, S.S., Narwal, S. and Malik, P.K., 2004.Effects of different rate and time of application of Pyrazosulfuron ethyl against weeds in transplanting method. *Haryana J. Agron*., **20**: 23-25.

Singh, S. K., Abraham, T., Kumar, R. and Kumar, R. 2017.Response of Crop Establishment Methods and Split Application of Nitrogen on Productivity of Rice under Irrigated Ecosystem. *Env. & Ecol.*, **35**: 859-62.

Subbaiah, S.V. and Sreedevi, B. 2000. Efficacy of herbicide mixtures on weed control in direct seeded rice under puddled condition. *Indian J.Weed Sci.*, **32**: 199-200.

Talla, A. and Jena, S. N.2014. Efficacy of different establishment methods and weed management practices on weed density, weed dry matter, weed control efficiency and yield under rainfed lowland rice. *Int. J. Pl. Animal Env. Sci.*, **4**:188-91.

Yadav, V. and Singh, B. 2006.Effect of crop establishment method and weed- management practice on rice *(Oryza sativa*) and associated weeds. *Indian J. Agron*., **51**: 301-03.